

MERIT BADGE SERIES



ENVIRONMENTAL SCIENCE



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STEM-Based

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"Enhancing our youths' competitive edge through merit badges"



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Environmental Science

1. Make a time line of the history of environmental science in America. Identify the contribution made by the Boy Scouts of America to environmental science. Include dates, names of people or organizations, and important events.
2. Define the following terms: population, community, ecosystem, biosphere, symbiosis, niche, habitat, conservation, threatened species, endangered species, extinction, pollution prevention, brownfield, ozone, watershed, airshed, nonpoint source, hybrid vehicle, fuel cell.
3. Do ONE activity from seven of the following categories (using the activities in this pamphlet as the basis for planning and projects):
 - (a) Ecology
 - (1) Conduct an experiment to find out how living things respond to changes in their environments. Discuss your observations with your counselor.
 - (2) Conduct an experiment illustrating the greenhouse effect. Keep a journal of your data and observations. Discuss your conclusions with your counselor.
 - (3) Discuss what is an ecosystem. Tell how it is maintained in nature and how it survives.
 - (b) Air Pollution
 - (1) Perform an experiment to test for particulates that contribute to air pollution. Discuss your findings with your counselor.
 - (2) Record the trips taken, mileage, and fuel consumption of a family car for seven days, and calculate how many miles per gallon the car gets. Determine whether any trips could have been combined (“chained”) rather than taken out and back. Using the idea of trip chaining, determine how many miles and gallons of gas could have been saved in those seven days.
 - (3) Explain what is acid rain. In your explanation, tell how it affects plants and the environment and the steps society can take to help reduce its effects.
 - (c) Water Pollution
 - (1) Conduct an experiment to show how living things react to thermal pollution. Discuss your observations with your counselor.

(2) Conduct an experiment to identify the methods that could be used to mediate (reduce) the effects of an oil spill on waterfowl. Discuss your results with your counselor.

(3) Describe the impact of a waterborne pollutant on an aquatic community. Write a 100-word report on how that pollutant affected aquatic life, what the effect was, and whether the effect is linked to biomagnification.

(d) Land Pollution

(1) Conduct an experiment to illustrate soil erosion by water. Take photographs or make a drawing of the soil before and after your experiment, and make a poster showing your results. Present your poster to your counselor.

(2) Perform an experiment to determine the effect of an oil spill on land. Discuss your conclusions with your counselor.

(3) Photograph an area affected by erosion. Share your photographs with your counselor and discuss why the area has eroded and what might be done to help alleviate the erosion.

(e) Endangered Species

(1) Do research on one endangered species found in your state. Find out what its natural habitat is, why it is endangered, what is being done to preserve it, and how many individual organisms are left in the wild. Prepare a 100-word report about the organism, including a drawing. Present your report to your patrol or troop.

(2) Do research on one species that was endangered or threatened but that has now recovered. Find out how the organism recovered, and what its new status is. Write a 100-word report on the species and discuss it with your counselor.

(3) With your parent's and counselor's approval, work with a natural resource professional to identify two projects that have been approved to improve the habitat for a threatened or endangered species in your area. Visit the site of one of these projects and report on what you saw.

(f) Pollution Prevention, Resource Recovery, and Conservation

(1) Look around your home and determine 10 ways your family can help reduce pollution. Practice at least two of these methods for seven days and discuss with your counselor what you have learned.

(2) Determine 10 ways to conserve resources or use resources more efficiently in your home, at school, or at camp. Practice at least two of these methods for seven days and discuss with your counselor what you have learned.

(3) Perform an experiment on packaging materials to find out which ones are biodegradable. Discuss your conclusion with your counselor.

(g) Pollination

(1) Using photographs or illustrations, point out the differences between a drone and a worker bee. Discuss the stages of bee development (eggs, larvae, pupae). Explain the pollination process, and what propolis is and how it is used by honey bees. Tell how bees make honey and beeswax,

and how both are harvested. Explain the part played in the life of the hive by the queen, the drones, and the workers.

(2) Present to your counselor a one-page report on how and why honey bees are used in pollinating food crops. In your report, discuss the problems faced by the bee population today, and the impact to humanity if there were no pollinators. Share your report with your troop or patrol, your class at school, or another group approved by your counselor.

Before you choose requirement 3g(3), you will need to first find out whether you are allergic to bee stings. Visit an allergist or your family physician to find out. If you are allergic to bee stings, you should choose another option within requirement 3. In completing requirement 3g(3), your counselor can help you find an established beekeeper to meet with you and your buddy. Ask whether you can help hive a swarm or divide a colony of honey bees. Before your visit, be sure your buddy is not allergic to bee stings. For help with locating a beekeeper in your state, visit www.bee-culture.com and click on "Resources," then select "Find Help" and "Find a Local Beekeeper."



(3) Hive a swarm OR divide at least one colony of honey bees. Explain how a hive is constructed.

(h) Invasive Species

(1) Learn to identify the major invasive plant species in your community or camp and explain to your counselor what can be done to either eradicate or control their spread.

(2) Do research on two invasive plant or animal species in your community or camp. Find out where the species originated, how they were transported to the United States, their life history, how they are spread, and the recommended means to eradicate or control their spread. Report your research orally or in writing to your counselor.

(3) Take part in a project of at least one hour to eradicate or control the spread of an invasive plant species in your community or camp.

4. Choose two outdoor study areas that are very different from one another (e.g., hilltop vs. bottom of a hill; field vs. forest; swamp vs. dry land). For BOTH study areas, do ONE of the following:

(a) Mark off a plot of 4 square yards in each study area, and count the number of species found there. Estimate how much space is occupied by each plant species and the type and number of nonplant species you find. Report to your counselor orally or in writing the biodiversity and population density of these study areas.

(b) Make at least three visits to each of the two study areas (for a total of six visits), staying for at least 20 minutes each time, to observe the living and non-living parts of the ecosystem. Space each visit far enough apart that there are

readily apparent differences in the observations. Keep a journal that includes the differences you observe. Discuss your observations with your counselor.

5. Using the construction project provided or a plan you create on your own, identify the items that would need to be included in an environmental impact statement for the project planned.
6. Find out about three career opportunities in environmental science. Pick one and find out the education, training, and experience required for this profession. Discuss this with your counselor, and explain why this profession might interest you.

Environmental Science Resources

Scouting Literature

Conservation Handbook; Fieldbook; Animal Science, Chemistry, Citizenship in the Community, Citizenship in the Nation, Citizenship in the World, Energy, Engineering, Fish and Wildlife Management, Fishing, Forestry, Gardening, Landscape Architecture, Mammal Study, Nature, Oceanography, Plant Science, Pulp and Paper, Soil and Water Conservation, Sustainability, and Weather merit badge pamphlets

For more information about Scouting-related resources, visit the BSA's online retail catalog (with your parent's permission) at <http://www.scoutstuff.org>.

Adams, Douglas, and Mark Carwardine. *Last Chance to See*. Harmony Books, 1990.

Bickerstaff, Linda. *Oil Power of the Future: New Ways of Turning Petroleum Into Energy*. The Rosen Publishing Group Inc., 2003.

Bowden, Rob. *Waste, Recycling, and Reuse*. Raintree Steck-Vaughn, 2002.

Carson, Rachel. *Silent Spring*. Houghton Mifflin, 2002.

Earthworks Group. *50 Simple Things Kids Can Do to Recycle*. Earthworks Press, 1994.

Fasulo, Mike, and Jane Kinney. *Careers for Environmental Types and Others Who Respect the Earth*. McGraw-Hill, 2001.

Hall, Eleanor J. *Garbage*. Gale Group, 1997.

Koebner, Linda. *For Kids Who Love Animals: A Guide to Sharing the Planet*. American Society for the Prevention of Cruelty to Animals. Living Planet Press, 1991.

MacEachern, Diane. *Save Our Planet*. Bantam Doubleday Dell, 1995.

O'Connor, Rebecca K. *Acid Rain*. Lucent Books, 2004.

Patent, Dorothy Hinshaw. *Biodiversity*. Houghton Mifflin, 2003.

Pringle, Laurence. *Global Warming*. Sea Star Books, 2001

———. *The Environmental Movement*. HarperCollins, 2000.

Rathje, William. *Rubbish! The Archaeology of Garbage*. HarperCollins, 1993.

Rybolt, Thomas R., and Robert C. Mebane. *Environmental Experiments About Land*. Enslow Publishers Inc., 1993.

Wilson, Edward O. *The Diversity of Life*. Norton, 1992.

Organizations and Websites

Earth 911

Telephone: 480-889-2650

Website: <http://www.earth911.com>

Environmental Protection Agency

Telephone: 202-272-0167

Website: <http://www.epa.gov>

Keep America Beautiful

Telephone: 203-323-8987

Website: <http://www.kab.org>

Natural Resources**Conservation Service**

Telephone: 202-720-3210

Website: <http://www.nrcs.usda.gov>**Save Our Environment**

Website:

<http://www.saveourevironment.org>**Sierra Club**

Telephone: 415-977-5500

Website: <http://www.sierraclub.org>**Society of American Foresters**

Telephone: 301-897-8720

Website: <http://www.eforester.org>**U.S. Fish and Wildlife Service**

Toll-free telephone: 800-344-9453

Website: <http://www.fws.gov>

Endangered species website:

<http://fws.gov/endangered/>**USDA Forest Service**

Telephone: 202-205-8333

Website: <http://www.fs.fed.us>**World Wildlife Fund**

Telephone: 202-293-4800

Website: <http://www.worldwildlife.org>**Acknowledgments**

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